10

Servers

12

Supply

18

15 — VIZ

Primary

17

Hosts

16

19

VIZ

Election

13

Pool

14

GL1

PARGE

DDT

DOT

Frame
0

Frame
1

• • •

Frame
N-1

11

Parallel application

FIGURE 1

Upper Wisker

Third Upper Quadrile

Median

First Lower Quadrile

Lower Wisker

FIGURE 2

COST-OF-SUPPLY (SUPPLY)

Supply (10)

FIGURE 3

$$\text{Supply}(\tau) = \frac{\text{Capacity} - \text{Utilization}(\tau)}{\text{Capacity}}$$

1.0

Capacity

$$\text{Cost} = \int \text{Supply}(\tau)\, d\tau$$

Median Supply

$$\tau = \frac{\text{time}}{\text{period}} = \frac{t}{T}$$

1.0

Period T

t_0

FIGURE 4

FIGURE 5

FIGURE 6

START

Hosts$_i$

$\vec{\text{Capacity}}_i$

$\vec{\text{Utilization}}(\tau_0)_i$

$\vec{\text{Supply}}(\tau_0)_i$

$t_i < T$ — NO

YES

$\vec{\text{Utilization}}(\tau_j)_i$

$\vec{\text{Supply}}(\tau_j)_i$

$\text{Cost}(\tau_j)_i$

$\text{Rank}(\tau_j)_i$

$$\vec{\text{Hosts}}_i \quad \text{Where} \begin{cases} \text{Dimension: } 0 \le \vec{\text{Host}}(i) \le \vec{\text{Server}}(N) \\ \text{Unit: Scalar} \\ \text{Form: Time independent vector}(i), \\ \qquad 0 \le i \le M \le N \end{cases} \quad [1]$$

$$\vec{\text{Capacity}}_i = (\text{CPU, memory, temp file, cache page})_i \quad [2]$$
$$\text{Where} \begin{cases} \text{Dimensions: CPU, data, data, data} \\ \text{Units: Scalar, byte, byte, byte} \\ \text{Form: Time independent, ix4 matrix} \end{cases}$$

$$\vec{\text{Utilization}}(t_0)_i = (\text{CPU, mem, tmp, page})(t_0)_i \quad [3]$$
$$\text{Where} \begin{cases} \text{Dimensions: CPU, data, data, data} \\ \text{Units: Scalar, byte, byte, byte} \\ \text{Form: Time dependent, ix4 matrix} \end{cases}$$

$$\vec{\text{Supply}}(t_0)_i = \vec{\text{Capacity}}_i - \vec{\text{Utilization}}(t_0)_i \quad [4]$$
$$\text{Where} \begin{cases} \text{Dimensions: CPU, data, data, data} \\ \text{Units: Scalar, byte, byte, byte} \\ \text{Form: Time dependent, ix4 matrix} \end{cases}$$

Where $0 \le \tau_j \le$ Sampling period T

$\vec{\text{Utilization}}(\tau_j)_i$ [3a]

$$\vec{\text{Supply}}(\tau_j)_i = \left(\vec{\text{Capacity}}_i - \vec{\text{Utilization}}(\tau_j)_i\right) \quad [4a]$$

$$\text{Cost}_i = 1 - \int \vec{\text{Supply}}(\tau_j)_i \, d_{\tau_i} \quad [5a]$$

$$\text{Where} \begin{cases} \text{Dimensions: None, none, none, none} \\ \text{Units: Scalar, scalar, scalar, scalar} \\ \text{Form: Time dependent vector }(t_i)_i \end{cases}$$

$$\vec{\text{Rank}}(t_j)_i = \text{Sort}[\vec{\text{Value}}(t_j)_i] \quad [6a]$$

$\vec{\text{Supply}}(\tau_j)_i$
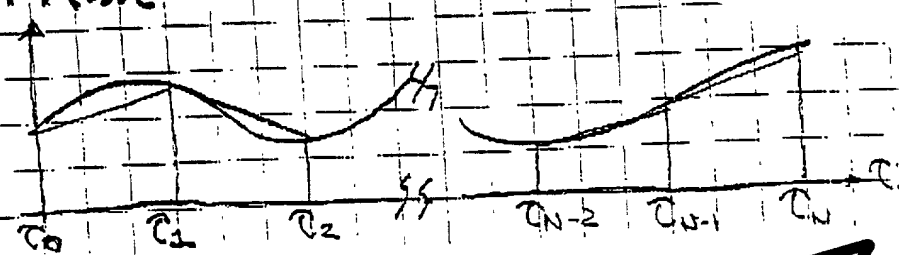
$\tau_0 \quad \tau_1 \quad \tau_2 \quad \tau_{N-2} \quad \tau_{N-1} \quad \tau_N$
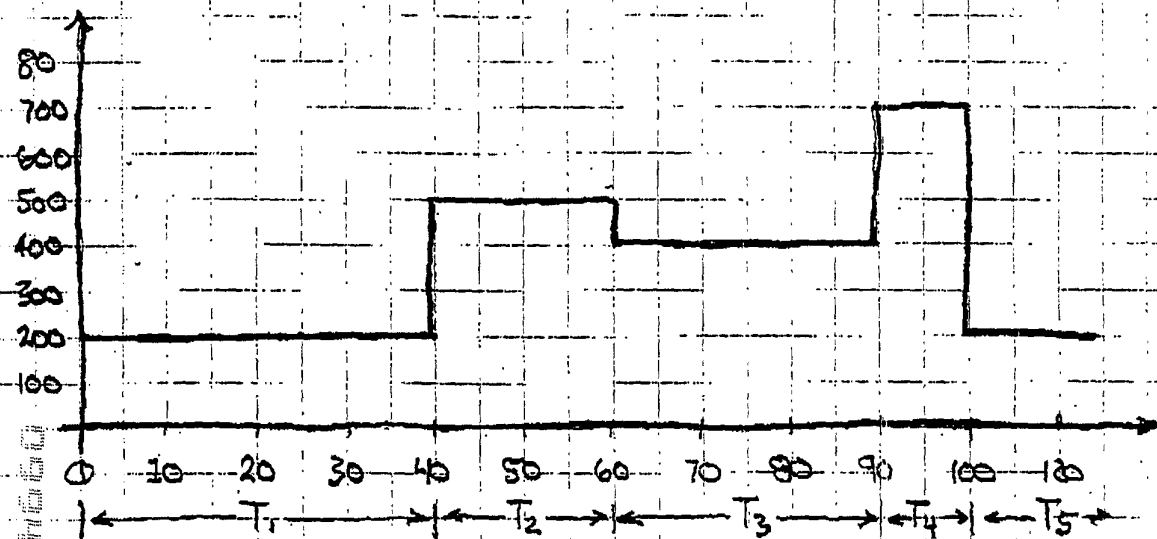
FIGURE 7

CAPACITY

FIGURE 7A

AREA = CAPACITY $\times T_1$

$= 200 \times 40 = 8000$

AREA = CAPACITY $\times \dfrac{T_1}{2}$

$= 1.0 \times 1.0 = 1.0$

FIGURE 7B

Supply (t) = CAPACITY - UTILIZATION (t)
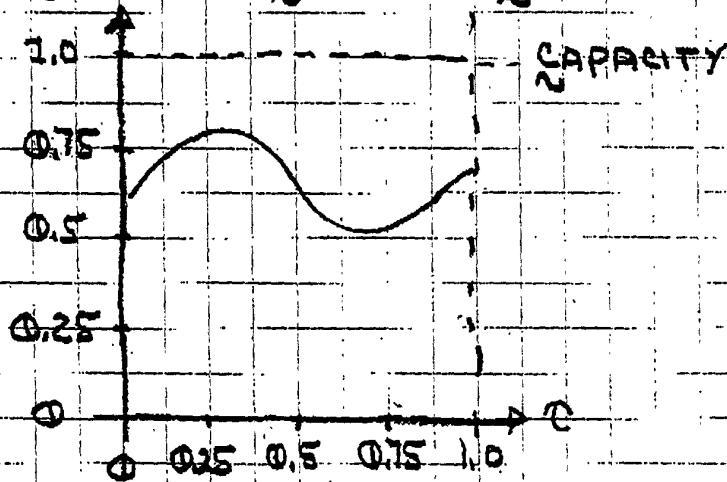

FIGURE 7C

Supply (τ) = CAPACITY - UTILIZATION (τ)

FIGURE 7D

$$\frac{d}{d\tau}\text{COST-OF-SUPPLY}(\tau)\uparrow \Rightarrow \downarrow \text{SUPPLY}(\tau)$$
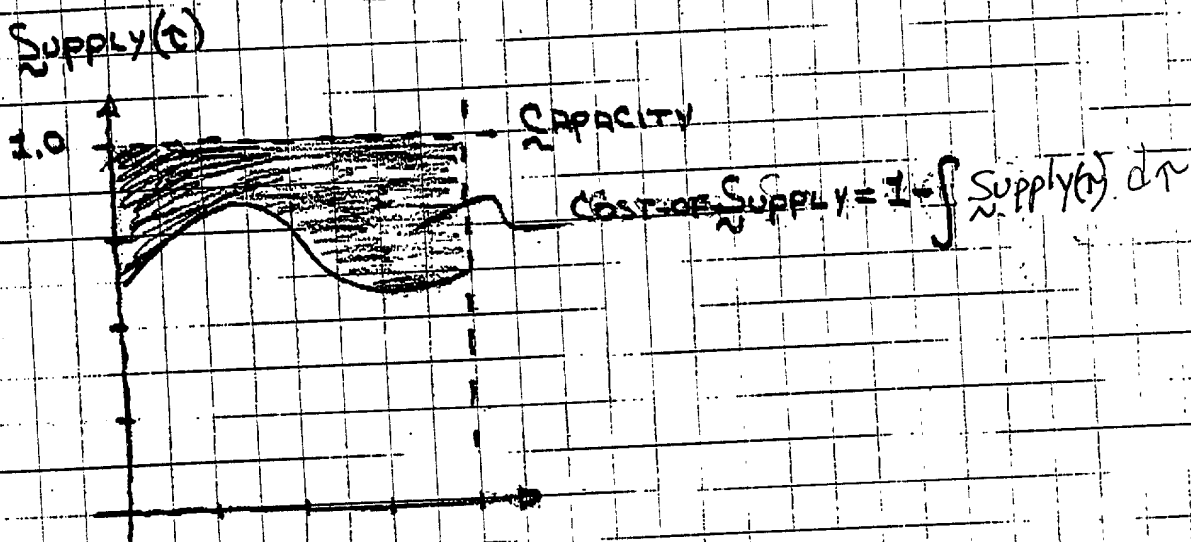
$$\text{COST-OF-SUPPLY} = \text{SUPPLY}(\tau)$$

$$\frac{d}{d\tau}\text{COST-OF-SUPPLY}(\tau)\downarrow \Rightarrow \uparrow \text{SUPPLY}(\tau)$$

FIGURE 7E

SUPPLY(τ)

1.0

CAPACITY

$$\text{COST-OF-SUPPLY} = 1 - \int \text{SUPPLY}(\tau)\, d\tau$$

FIGURE 7F

FROM PRIMARY

MPICH.POOL

POE → ELECTION

Data-Density Table
(DDT) from ParCE

Data-Owner Table
(DOT) to ParCE

MPICH.NOW

TO APPLICATION

FIGURE 8

FIGURE 9

FIG.11

FIG.10